# Agilent E5100A/B Network Analyzer

# User's Guide

**SERIAL NUMBERS**

This manual applies directly to instruments which has the serial number prefix JP2KC,JP3KC,JP4KC,JP5KC and MY405, or firmware revision 2.xx and 3.xx.
For additional important information about serial numbers, read "Serial Number" in Appendix A.

Agilent Technologies

**Agilent Part No. E5100-90051**
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**Sixth Edition**

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## Manual Printing History

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## Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.
*The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.*

**Note**

E5100A/B complies with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. E5100A/B is INDOOR USE product.

**Note**

LEDs in E5100A/B are Class 1 in accordance with IEC825-1.
CLASS 1 LED PRODUCT

### Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

### DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

### Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

### DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

### DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

## Dangerous Procedure Warnings

**Warnings** , such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

**Warning**

**Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

## Typeface Conventions

| | |
|---|---|
| **Bold** | Boldface type is used when a term is defined. For example: **icons** are symbols. |
| *Italics* | Italic type is used for emphasis and for titles of manuals and other publications. |
| | Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: `copy` *filename* means to type the word `copy`, to type a space, and then to type the name of a file such as `file1`. |
| `Computer` | Computer font is used for on-screen prompts and messages. |
| HARDKEYS | Labeled keys on the instrument front panel are enclosed in ▢. |
| SOFTKEYS | Softkeys located to the right of the LCD are enclosed in ▯. |

## Certification

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The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

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## Safety Symbols

General definitions of safety symbols used on equipment or in manuals are listed below.

Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.

Alternating current.



Direct current.



On (Supply).

Off (Supply).

In position of push-button switch.

Out position of push-button switch.

Frame (or chassis) terminal. A connection to the frame (chassis) of the equipment which normally include all exposed metal structures.

**Warning**

This **Warning** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

**Caution**

This **Caution** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

**Note**

This **Note** sigh denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Affixed to product containing static sensitive devices use anti-static handling procedures to prevent electrostatic discharge damage to component.

# Documentation Guide

Please refer to the following manuals for the operation of the analyzer where necessarily.

**User's Guide (Option ABA only) (Agilent Part Number E5100-900X1)**

This documents explains the method to set up and basic operations of E5100A/B in simple steps.

**Function Reference (Option ABA only) (Agilent Part Number E5100-900X0)**

The Function Reference describes all function accessed from the front panel keys and softkeys. It also provides information on options and accessories available, specifications, system performance, and some topics about the analyzer's features.

**Programming Manual (Option ABA only) (Agilent Part Number E5100-900X7)**

The Programming Manual shows how to write and use BASIC program to control the analyzer and provides a summary of all available GPIB commands.

**Instrument BASIC Users Handbook (Option ABA only) (Agilent Part Number 04155-90150)**

The Instrument BASIC Users Handbook introduces you to the Instrument BASIC programming language, provide some helpful hints on getting the most use from it, and provide a general programming reference. It is divided into three books, *Programming Techniques*, *Interface Techniques*, and *Language Reference*.

**Service Manual (Option 0BW only), (Agilent Part Number E5100-901X0)**

The Service Manual explains how to adjust, troubleshoot, and repair the instrument. This manual is option 0BW only.

The number indicated by "x" in the part number of each manual, is incremented by 1 each time a revision is made. The latest edition comes with the product.

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# 1

# Introduction

This manual explains setting up and starting the analyzer, basic measuring procedure.

## Overview of E5100A/B

E5100A/B is a 10 kHz to 300 MHz network analyzer fitted for production lines of electric component manufactures.

E5100A/B has the following features:

- Frequency range from 10 kHz to 300 MHz.
- 0.04 ms/point (fastest) measurement speed
- Ramp sweep and step sweep
- Fine resolution IFBW (10 Hz to 30 kHz with 1, 1.5, 2, 3, 4, 5, 8 steps)
- Stable measurements (120 dB dynamic range @1 kHz IF BW)
- To provide fast waveform analysis commands
- 3-mode DOS flexible disk drive (720 kbyte, 1.2 Mbyte, and 1.44 Mbyte)

## Overview

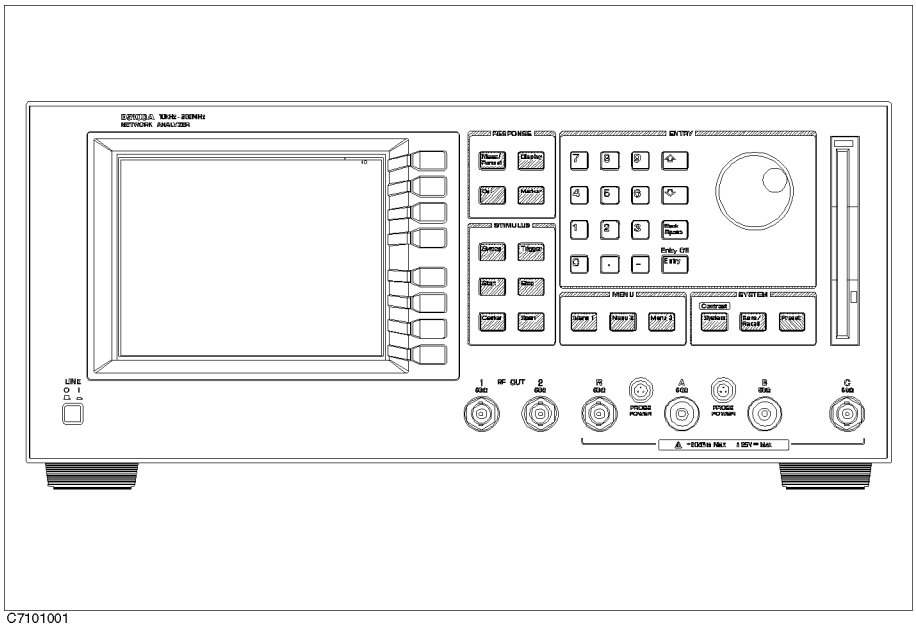


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**Figure 1-1. Overview of E5100A**

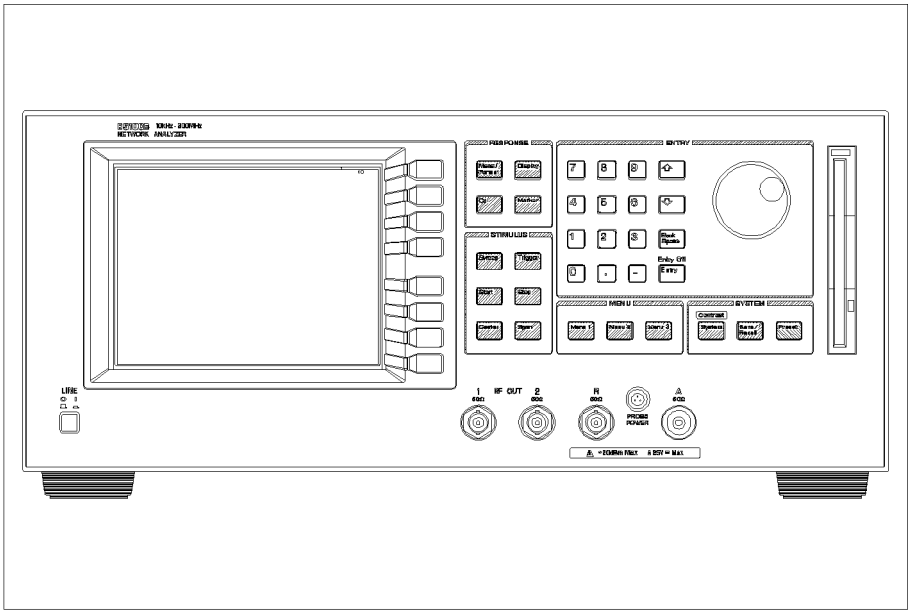


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**Figure 1-2. Overview of E5100B**

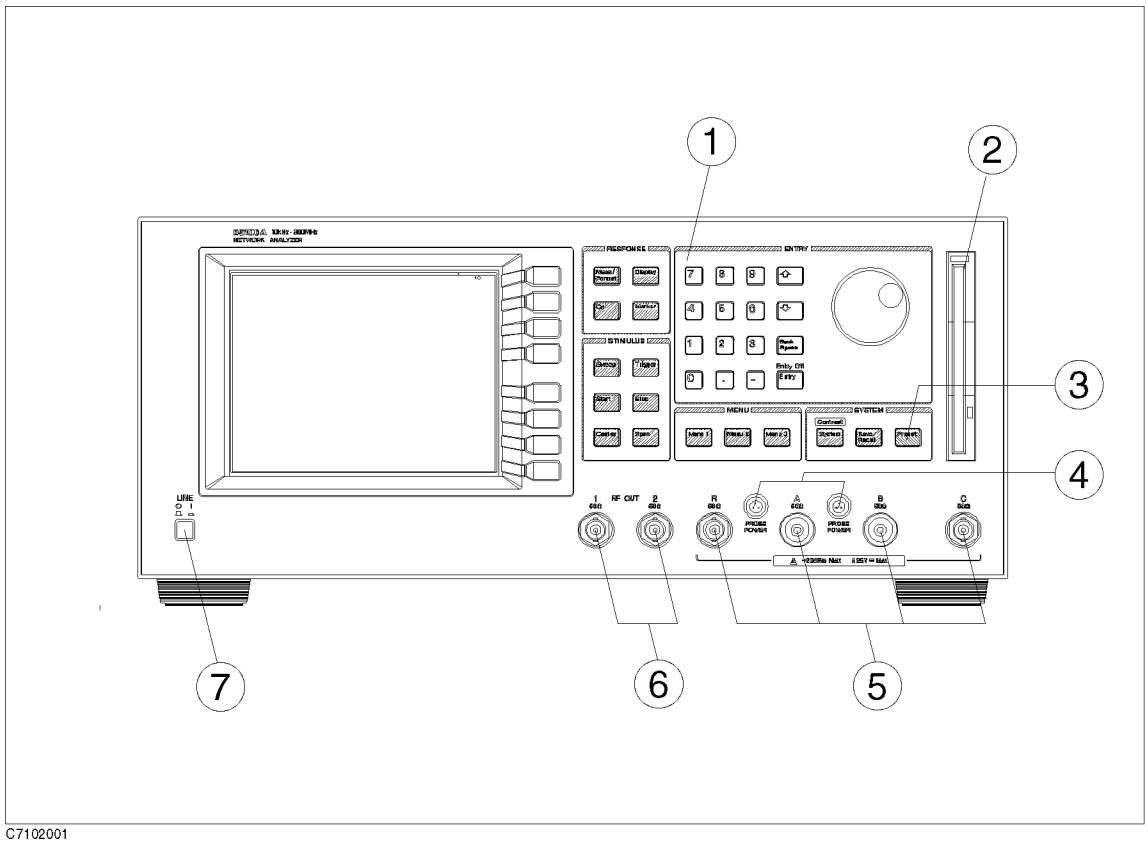
# 2

# Front and Rear Panel

This chapter describes the features of the front and rear panels of the analyzer. It provides illustrations and descriptions of the front panel features, the LCD display and its labels, and the rear panel features and connectors.

## Front Panel

Analyzer functions are activated from the front panel (Figure 2-1) by using the front panel hardkeys or softkeys.




C7102001

**Figure 2-1. Analyzer Front Panel**

# 1. Front Panel Keys and Softkeys

Some of the front panel keys change instrument functions directly, and others provide access to additional functions available in softkey menus. Softkey menus are lists of up to eight related functions that can be displayed in the softkey label area at the right-hand side of the display. The eight keys to the right of the LCD are the softkeys. Pressing one of the softkeys selects the adjacent menu function. This either executes the labeled function and makes it the active function, causes instrument status information to be displayed, or presents another softkey menu.

Some of the analyzer's menus are accessed directly from front panel keys and some from other menus. For example, the sweep menu accessed by pressing the (Sweep) key presents all the sweep functions such as sweep type, number of points, and sweep time. Pressing `NUMBER of POINTS` allows the required number of points displayed per sweep to be entered directly from the number pad. `RETURN` softkeys return to previous menus. `DONE` indicates completion of a specific procedure and then returns to an earlier menu.

Usually, when a menu changes, the present active function is cleared.

### Softkeys that are Joined by Vertical Lines

When several possible choices are available for a function, the softkeys are joined by vertical lines. For example, trigger menu under the (Trigger) key, the available inputs are listed: `HOLD` , `SINGLE` , `CONTINUOUS` with a vertical line between them. Note that only one softkey can be selected at a time. When a selection has been made from the listed alternatives, that selection is underlined until another selection is made.

### Softkeys That Toggle On or Off

Some softkey functions can be toggled ON or OFF, for example averaging. This is indicated in the softkey label. The current state, ON or OFF, is capitalized in the softkey label.

Example:

| | |
|---|---|
| `SMOOTHING ON off` | The word on is capitalized, showing that smoothing is currently on. |
| `SMOOTHING on OFF` | The word off is capitalized, showing that smoothing is currently off. |

### Softkeys that Show Status Indications in Brackets

Some softkey labels show the current status of a function in brackets. These include simple toggle functions and status-only indicators. An example of a toggled function is the `SWEEP DIR [UP]` or `SWEEP DIR [DOWN]` softkey. The `TRIG EVENT [ ]` softkey is an example of a status-only indicator, where the selected equation of the data math function is shown in brackets in the softkey label.

### 2. Built-in Flexible Disk Drive

Stores the measurement data, instrument status, and HP Instrument BASIC programs. The applicable disk format is DOS (disk operating system) format.

### 3. Preset

This key returns the instrument to a known standard preset state from any step of any manual procedure.

### 4. PROBE POWER Connector

This connector (fused inside the instrument) supplies power to an active probe for in-circuit measurements of AC circuits.

### ⚠ 5. Inputs R, A, B, and C

These inputs receive signals from source or DUT. The R input is used as the reference input. The number of inputs is depends on the option. The input impedance of each input is 50 Ω. When the analyzer is equipped with option 101 or 301, the input impedance can be selected, 50 Ω or 1 MΩ.

INSTALLATION CATEGORY I

### 6. RF OUT Connector

These two connecters output the RF signal. The same RF signals are outputted from these two connector because the power splitter is builted in the analyzer. The output impedance at this connector is 50 Ω. When the analyzer is equipped with the option 001, the output is changed to single. When the analyzer is equipped with option 003, the switch is installed instead of the power splitter.

### 7. LINE Switch

This controls ac power to the analyzer. 1 is ON, 0 is OFF.

## Screen display

Displays a grid on which the measurement data is plotted, the currently selected measurement traces, and other information describing the measurement. Figure 2-3 shows the locations of the different information labels.

In addition to the full-screen display shown in Figure 2-3, a split display is available. In this case, information labels are provided for each half of the display.

The screen can also be used as the HP Instrument BASIC display. HP Instrument BASIC uses either a full-screen display or a half-screen display below the graticule display as a text screen.

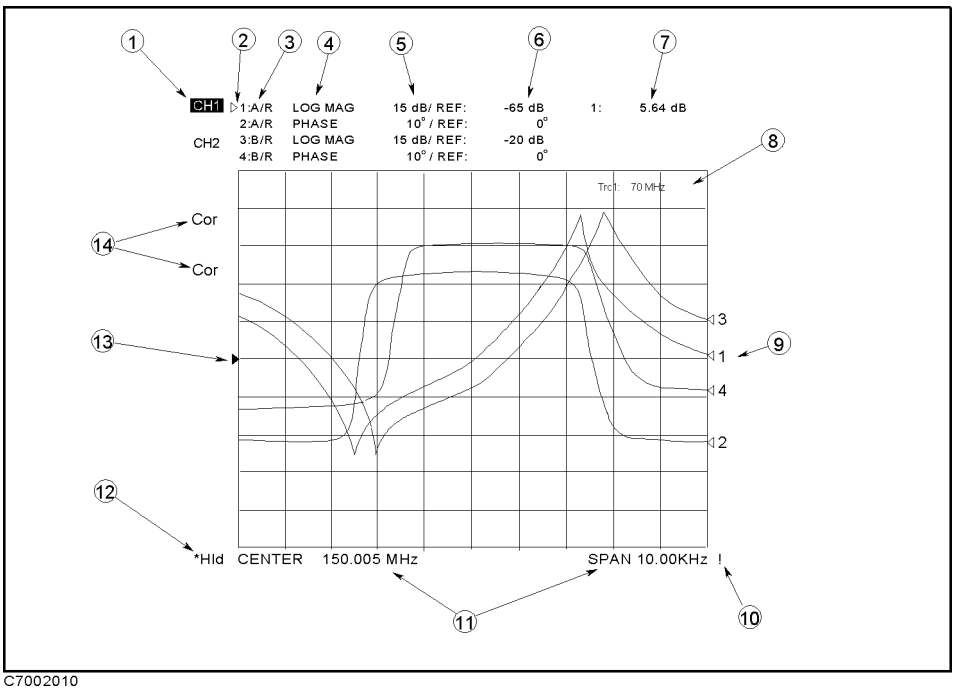



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**Figure 2-2. Screen Display**

**1. Channel Number** Highlights the displayed channel number. The active channel is indicated by reverse display characters.

**2. Trace Number** Displays trace numbers. The active trace is indicated by a small triangle to the left of the trace number.

**3. Measured Input(s)** Shows the input or ratio of inputs currently measured as selected using `Meas` under the (Meas/Format) key. The measured inputs is shown when the function is set to gain-phase

**4. Format** Shows the format selected using `Format` under the (Meas/Format) key.

**5. Top and Bottom Value**

Displays the top and bottom values of the grid selected by `SCALE MENU` under the (Display) key. When the function is set to impedance measurement and the Y-axis is set to log format, the grid scale is not scale/div format but top and bottom format.

**6. Reference Level** Displays the value of a reference line in Cartesian formats. It is selected using SCALE MENU under the (Display) key. However, the reference line is invisible (it is indicated by a small triangle adjacent to the graticule at the left).

**7. Marker Data Readout**

Displays the values of the marker in units appropriate to the current measurement.

**8. Marker Stimulus** Displays the stimulus value of the marker.

**9. Trace number** Indicates the trace number for the measurement trace.

**10. Service Notation** Indicates the analyzer is in service mode or self test was failed. See *E5100A/B Service Manual*

**11. Stimulus Value** Displays the start/stop or the center/span values of frequency or power.

**12. Sweep Notations** Displays one of the following the sweep conditions:

| | |
|---|---|
| Hld | Hold sweep (HOLD under the (Trigger) key). |
| Ext | Wait external trigger (TRIG EVENT under the (Trigger) key). |
| ↑ | Under sweep |
| * | Stimulus parameters changed: measured data in doubt until a complete fressh sweep has been taken. |

**13. Reference Position** Indicates the reference position.

**14. Status Notations** Displays the current status of various functions for each channels. The following notations are used:

| | |
|---|---|
| Cor | Error correction is on (Correction on OFF under the (Cal) key). |
| C? | Stimulus parameters have changed, and interpolated error correction is on. |
| C! | Stimulus parameters have changed, and interpolated error correction is not available. |
| Del | Electrical delay or phase offset has been added or subtracted (SCALE MENU under the (Display) key). |
| Smo | Trace smoothing is on (SMOOTHING on OFF under the (Display) key). |

For example, the upper Cor in Figure 2-2 is for channel 1 and the lower one is for channel 2.

# Rear Panel Features and Connectors

Figure 2-3 shows the features and connectors on the rear panel. Requirements for the input signals to the rear panel connectors are provided in the Specification chapter in the *E5100A/B Function Reference*.

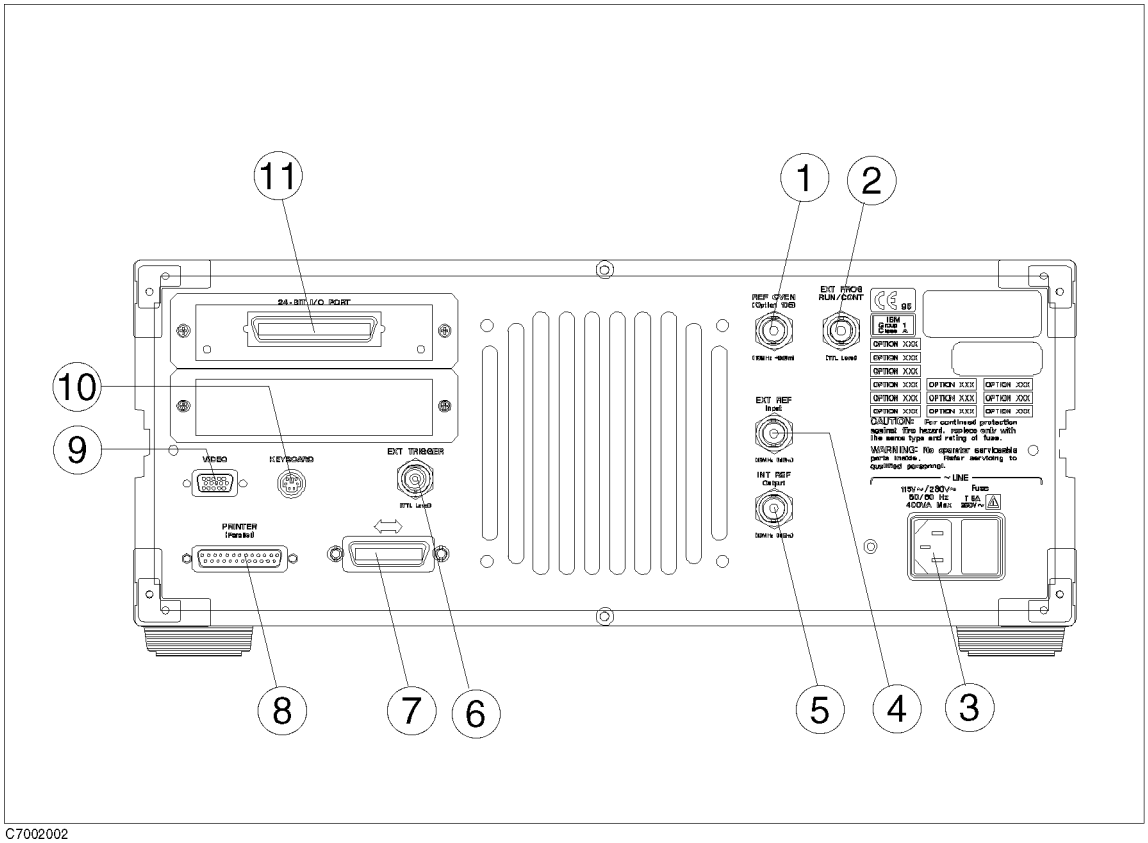


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**Figure 2-3. Analyzer Rear Panel**

## 1. Reference Oven Output (Option 1D5 Only)

Connects to the EXT REF INPUT connector when Option 1D5 is installed. Option 1D5 improves the frequency accuracy and stability of the analyzer.

## 2. External Program RUN/CONT Input

Externally triggers RUN or CONT of the HP Instrument BASIC program. The positive edge of a pulse more than 20 $\mu$s wide in the LOW state triggers RUN or CONT. The signal is TTL-compatible. When the analyzer is equipped with option UKR, this connector is deleted.

**3. Power** This is input for the main power cable. Insert the main-power cable plug only into a socket outlet that has a protective ground contact.

**4. External Reference Input**

Connects an external frequency reference signal to the analyzer that is used to phase lock the analyzer for increased frequency accuracy.

When the analyzer is equipped with option 1D5, this connector must be connected to REF OVEN connector.

The external frequency reference function is automatically enabled when a signal is connected to this input. When the signal is removed, the analyzer automatically switches back to its internal frequency reference.

**5. Internal Reference Output**

Connects to the frequency reference input of an external instrument to phase lock it to the analyzer.

**6. External Trigger Input**

Triggers a measurement sweep. The positive edge of a pulse more than 20 $\mu$s wide in the LOW state starts a measurement. The signal is TTL-compatible. To use this connector, set the trigger mode to external using softkey functions.

**7. GPIB Interface** Connects the analyzer to an external controller and other instruments in an automated system. This connector is also used when the analyzer itself is the controller of compatible peripherals.

**8. Printer Interface** Connects the analyzer to an external printer. The interface is centronics compatible.

**9. Video Outputs (VGA)**

Connects the VGA video monitor.

**10. DIN Keyboard Connector**

Connects the keyboard that is usually used with HP Instrument BASIC. DIN keyboard is furnished when the analyzer is equipped with HP Instrument BASIC (option 1D5)

**11. I/O Port** Connects to external devices such as a handler on a production line.

# 3

# Installation and Set Up Guide

This chapter provides the information necessary for performing an incoming inspection and setting up E5100A/B.

The main topics in this chapter are:

- Incoming Inspection
- Power Cable
- Power requirements
- Ventilation Requirements
- Instruction for Cleaning
- Rack Mounting Installation

## Incoming Inspection

**Warning**

**To avoid hazardous electrical shock, do not turn on the E5100A/B when there are signs of shipping damage to any portion of the outer enclosure (for example, covers, panel, or display)**

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the E5100A/B has been checked mechanically and electrically. The contents of the shipment should be as listed in Table 3-1. If the contents are incomplete, if there is mechanical damage or defect, or if the analyzer does not pass the power-on selftests, notify the nearest Agilent Technologies office. If the shipping container is damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Agilent Technologies office. Keep the shipping materials for the carrier's inspection.

## Table 3-1. E5100A/B Contents

| Description | Qty. | Agilent Part Number |
|---|---|---|
| **E5100A/B** | | |
| Power cable[1] | 1 | — |
| Sample program disk | 1 | E5100-180X0[2] |
| CD-ROM(Manuals) | 1 | E5100-905xx[3] |
| **Option ABA Add Manuals** | | |
| Function Reference | 1 | E5100-900X0[3] |
| Programming Manual | 1 | E5100-900X7[3] |
| User's Guide | 1 | E5100-900X1[3] |
| Instrument BASIC Users Handbook | 1 | 04155-90150 |
| Instrument BASIC Users Handbook Supplement | 1 | E5100-900X5[3] |
| **Option 0BW Add Service Manual** | | |
| Service Manual | 1 | E5100-901X0[3] |
| **Option 1CM Rack Mount Kit** | | |
| Rack mount kit | 1 | 5062-3978 |
| **Option 1CN Front Handle Kit** | | |
| Front handle kit | 1 | 5062-3990 |
| **Option 1CP Rack and Handle Kit** | | |
| Rack and handle kit | 1 | 5062-3984 |
| **Option 1D5 High Stability Frequency** | | |
| BNC Adapter | 1 | 1250-1859 |
| **Option 1F0 External Keyboard** | | |
| Keyboard | 1 | — |

1 Power Cable depends on where the instrument is used, see Figure 3-1.

2 Furnished with special sample program disk (E5100-180X1) as well as the original one if Option 022/023 is designated. The number indicated by "X" in the part number of the sample program disk, is allocated for numbers increased by one each time a revision is made. The latest edition comes with the product.

3 The number indicated by "X" in the part number of each manual, is allocated for numbers increased by one each time a revision is made. The latest edition comes with the product.

## Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame. The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 3-1 for the part numbers of the power cables available.

**Warning**

**For protection from electrical shock, the power cable ground must not be defeated. The power plug must be plugged into an outlet that provides a protective earth ground connection.**

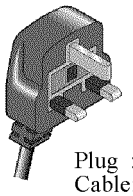
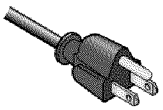
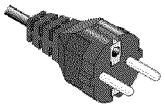
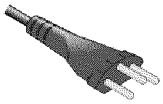
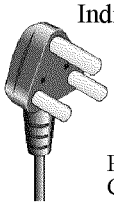
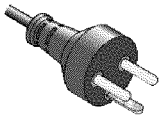
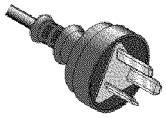
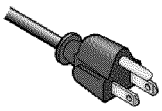
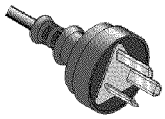
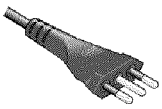
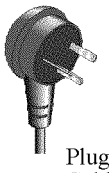
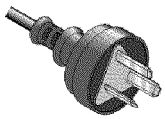
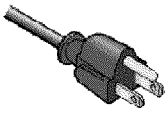
| | |
|---|---|
| OPTION 900 United Kingdom  Plug : BS 1363/A, 250V, 10A Cable: 8120-1351 | OPTION 903 U.S./ Canada  Plug : NEMA 5-15P, 125V, 10A Cable: 8120-1378 |
| OPTION 902 Continental Europe  Plug : CEE 7 Standard Sheet VII, 250V, 10A Cable: 8120-1689 | OPTION 906 Switzerland  Plug : SEV Type 12, 250V, 10A Cable: 8120-2104 |
| OPTION 904 U.S./ Canada Plug : NEMA 6-15P, 250V, 6A Cable: 8120-0698 | OPTION 917 India/ Republic of S.Africa  Plug : IEC 83-B1, 250V, 10A Cable: 8120-4211 |
| OPTION 912 Denmark  Plug : SR 107-2-D, 250V, 10A Cable: 8120-2956 | OPTION 920 Argentina  Plug : Argentine Resolution 63, Annex IV, 250V, 10A Cable: 8120-6870 |
| OPTION 918 Japan  Plug : JIS C 8303, 125V, 12A Cable: 8120-4753 | OPTION 922 China  Plug : GB 1002, 250V, 10A Cable: 8120-8376 |
| OPTION 921 Chile  Plug : CEI 23-16, 250V, 10A Cable: 8120-6978 | OPTION 919 Israel  Plug : Israel SI 32, 250V, 10A Cable: 8120-5182 |
| OPTION 901 Australia/ New Zealand  Plug : AS 3112, 250V, 10A Cable: 8120-1369 | OPTION 927 Thailand  Plug : NEMA 5-15P, 250V, 10A Cable: 8120-8871 |
| NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90° etc.). | |

**Figure 3-1. Power Cable Supplied**

## Power Requirements

E5100A/B requires a following power source:

Voltage : 90 to 132 Vac, 198 to 264 Vac

Frequency : 47 to 63 Hz

Power : 400 VA maximum

## Providing clearance to dissipate heat at installation site

To ensure the specifications and measurement accuracy of the product, you must keep ambient temperature around the product within the specified range by providing appropriate cooling clearance around the product or, for the rackmount type, by forcefully air-cooling inside the rack housing. For information on ambient temperature to satisfy the specifications and measurement accuracy of the product, refer to *Function Reference Chapter 10, Instrument Specifications.*

When the ambient temperature around the product is kept within the temperature range of the operating environment specification (refer to "Operating Conditions" in the Function Reference Chapter 10), the product conforms to the requirements of the safety standard. Furthermore, under that temperature environment, it has been confirmed that the product still conforms to the requirements of the safety standard when it is enclosed with cooling clearance as follows:

**Table 3-2.**

| | Conditions |
|---|---|
| Rear | 180 mm |
| Side | 60 mm |
| Upper | 15 mm |

## Instruction for Cleaning

For cleaning, wipe with soft cloth that is soaked with water and wrung tightly without undue pressure.

## Rack/Handle Installation

The analyzer can be rack mounted and used as a component in a measurement system. Figure 3-2 shows how to rack mount the E5100A/B.

**Table 3-3. Rack Mount Kits**

| Option | Description | Agilent Part Number |
|---|---|---|
| 1CN | Handle Kit | 5062-3990 |
| 1CM | Rack Mount Kit | 5062-3978 |
| 1CP | Rack Mount&Handle Kit | 5062-3984 |

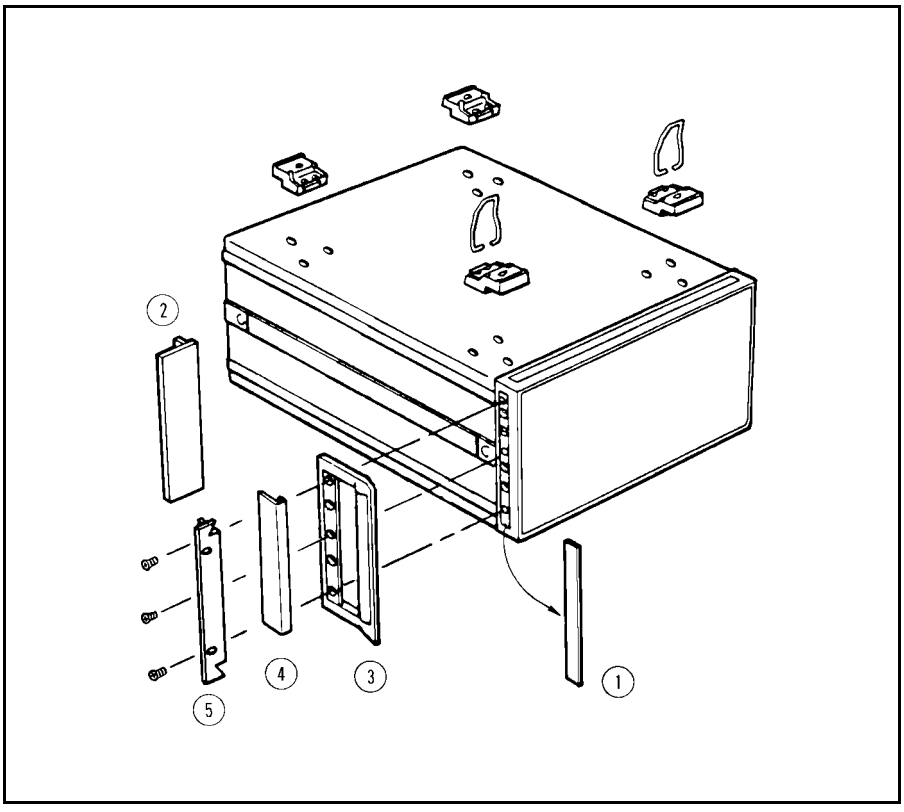



**Figure 3-2. Rack Mount Kits Installation**

## Option 1CN Handle Kit

Option 1CN is a handle kit containing a pair of handles and the necessary hardware to attach them to the instrument.

### Installing the Handle

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the E5100A/B. (Refer to Figure 3-2.)
2. Attach the front handles ③ to the sides using the screws provided.
3. Attach the trim strips ④ to the handles.

## Option 1CM Rack Mount Kit

Option 1CM is a rack mount kit containing a pair of flanges and the necessary hardware to mount them to the instrument in an equipment rack with 482.6 mm (19 inches) horizontal spacing.

### Mounting the Rack

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the E5100A/B. (Refer to Figure 3-2.)
2. Attach the rack mount flange ② to the left and right front sides of the E5100A/B using the screws provided.
3. Remove all four feet (lift bar on the inner side of the foot, and slide the foot toward the bar.)

## Option 1CP Rack Mount & Handle Kit

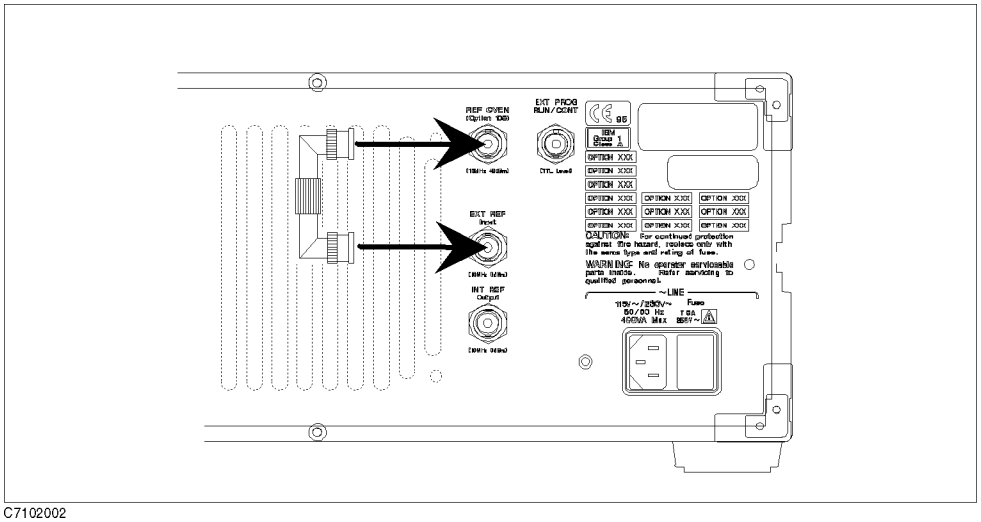
Option 1CP is a rack mount kit containing a pair of flanges and the necessary hardware to mount them to an instrument which has handles attached, in an equipment rack with 482.6 mm (19 inches) spacing.

### Mounting the Handle and Rack

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the E5100A/B. (Refer to Figure 3-2.)
2. Attach the front handle ③ and the rack mount fringe ⑤ together on the left and right front sides of the E5100A/B using the screws provided.
3. Remove all four feet (lift bar on the inner side of the foot, and slide the foot toward the bar).

## Connecting a BNC Adapter (Option 1D5 Only)

When Option 1D5 is installed, connect a BNC adapter between the REF OVEN output and the EXT REF Input on the rear panel of the analyzer. The BNC adapter is included in Option 1D5. Option 1D5 improves the frequency accuracy and stability of the analyzer.




C7102002

**Figure 3-3. Connecting a BNC Adapter**

## Connecting a Keyboard (Option 1F0 only)

An DIN keyboard can be connected to the DIN connector on the rear panel of the analyzer. The DIN keyboard provides an easier way to enter characters for the file names, display titles, and Instrument BASIC programs. It can also access the analyzer softkey functions by using keyboard function keys. For more information on the DIN keyboard, see the *HP Instrument BASIC Manual Supplement*.

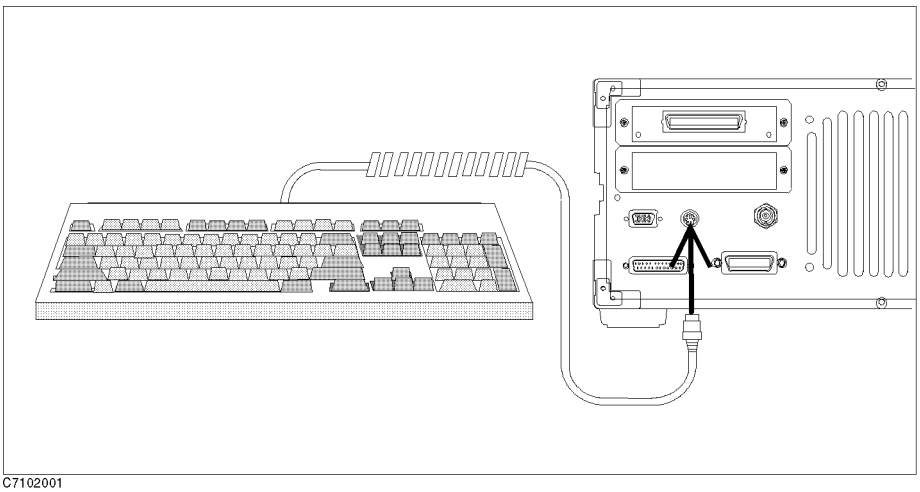
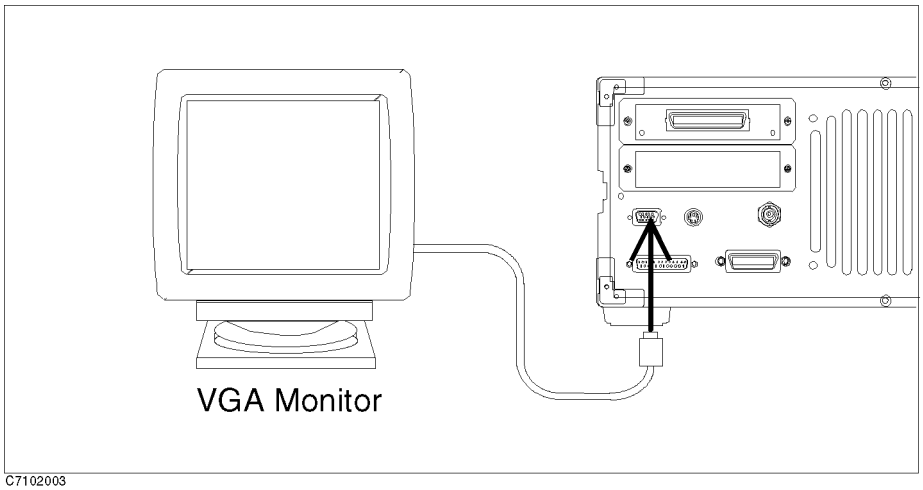

C7102001

**Figure 3-4. Connecting a Keyboard**

## Connecting a VGA Monitor

A VGA monitor can be connected to the VGA connector on the rear panel of the analyzer. The VGA monitor provides an easier way to watch display.



C7102003

**Figure 3-5. Connecting a VGA Monitor**

# 4

# Quick Start Guide

In this chapter, you will learn how to make a basic network analyzer measurement by measuring the transmission characteristics of a bandpass filter.

## Overview

The following is a short summary of this chapter:

1. Preparing for a measurement
   - Connecting peripherals
   - Connecting DUT
2. Turning ON the analyzer
3. Setting up the analyzer
   - Setting the function
   - Selecting the input ports
   - Selecting the measurement format
   - Setting the frequency range
   - Performing the automatic scaling
4. Making a calibration
   - Performing a Response Calibration
5. Reading a measurement result
   - Reading a measured value by using marker

## Required Equipment

To perform all the steps in this chapter, you must have the following equipment:

- E5100A/B Network Analyzer
- Measurement device:
  - This tour assumes the device under test (DUT) is a 70 MHz bandpass filter
- THRU (BNC female-to-female connector)
- Three BNC cables

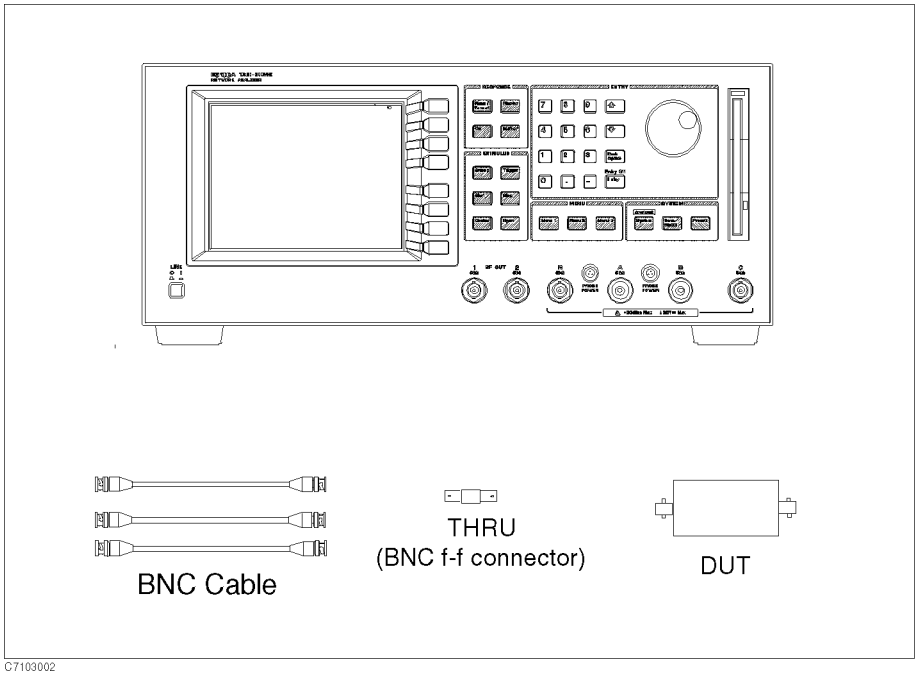



**Figure 4-1. Required Equipment**

## ⚠ Step1 : Preparing for a measurement

- ⚠ Connect the RF OUT 1 port to DUT with a BNC cable.
- ⚠ Connect the A port to DUT with a BNC cable.
- ⚠ Connect the RF OUT 2 port to the R port with BNC cable.

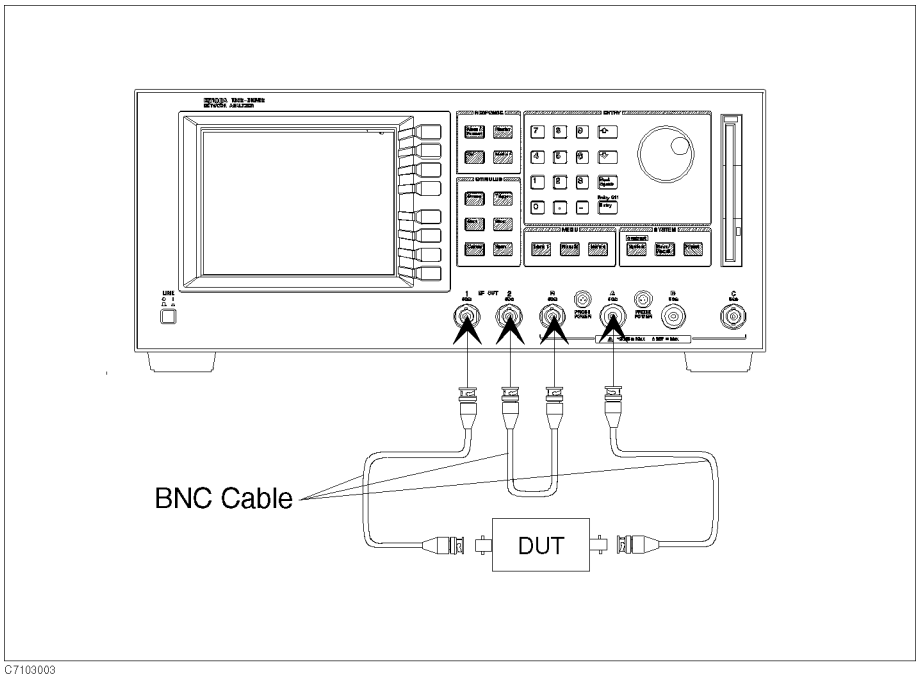
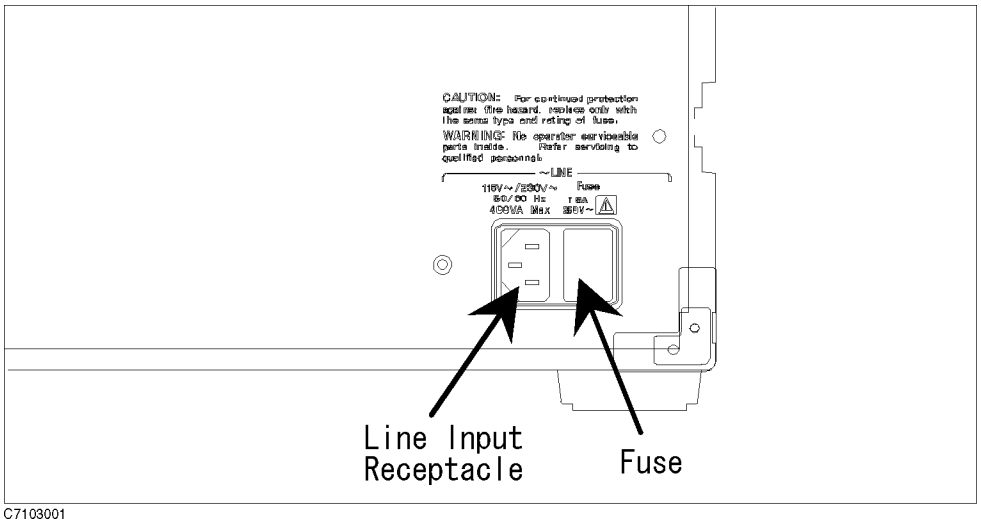



**Figure 4-2. Connection of Measurement Cables**

# Step 2 : Turning ON the analyzer




C7103001

**Figure 4-3. Line Input Receptacle and Fuse**

**Line Input Receptacle** AC Power cable is connected to this receptacle.

**⚠ Fuse** Use the following fuse:

Agilent Part Number : 2110-0030

(UL/CSA type, time delay 5 A 250 Vac)

If you need this fuse, contact your nearest Agilent Technologies Sales and Service Office.

## Steps to turn on the power

1. Connect AC power cable to the line input receptacle
2. Turn on E5100A/B (need 30 minutes warm up).

## Step3 : Setting up the Analyzer

Before you start the measurement, you must set up the analyzer to fit your measurement requirements. For example, you must set the frequency range of the measurement. In this step, you will set the following parameters:

| | |
|---|---|
| **Function** | Gain/Phase |
| **Inputs** | A/R |
| **Format** | Log magnitude (default) |
| **Frequency Range** | Center 70 MHz, Span 500 kHz |

### Setting the function

- Press (Meas/Format) `FUNCTION[ ]` `GAIN-PHASE`.

### Selecting the input ports

- Press (Meas/Format) `MEAS[ ]` `A/R`.

### Selecting the measurement format

- Press (Meas/Format) `FORMAT` `LOG MAG & PHASE`.

### Setting the frequency range

- Press (Center) (7) (0) `x M`.
- Press (Span) (5) (0) (0) `x k`.

### Performing the automatic scaling

- Press (Display) `AUTO SCALE`.

### Setting the IF band width

- Press (Sweep) `IF BW []`.
- Change the IF BW value using the numeric key, arrow key, or RPG knob so that the dynamic range can be increased.

## Step4 : Making a calibration

To ensure accurate measurement results, calibrate the analyzer before making a measurement. Calibration reduces error factor due to uncertainty. In this example, you perform the response calibration to cancel a frequency response error. A THRU (BNC female-to-female connector) is necessary to perform a response calibration for the transmission measurement.

### Performing a Response Calibration

- Press (Cal) RESPONSE .
- Disconnect the DUT then, connect the THRU.
- Press THRU . The THRU softkey label is underlined when the measurement is completed.
- Press DONE:
- Disconnect the THRU and reconnect the DUT.

"Cor" is displayed on the left side of the display to show that the frequency response error is corrected.

The measured value is now corrected for the frequency response error.

**Note**

If the trace is changed, it requires an adjustment of the scale. Perform the automatic scaling again by pressing (Display) AUTO SCALE .

## Step5 : Reading a measurement result

You may want to readout the measured values on the displayed trace. You can use the marker function for this purpose. The marker shows the frequency and response value at the marker point.

### Reading a measured value by using marker

- Press (Marker).
- Verify a marker labeled 1 appears on the trace of log mag.
- Turn the knob to the right to move the marker toward the right.
- Read the value at the right top of the display.
- Press `ACTIVE MARKER 2 RETURN`.
- Verify a marker labeled 2 appears on the trace of log mag.
- Turn the knob to the left to move the marker toward the left.
- Press `ACTIVE TRC [MAIN]` to change to `ACTIVE TRC [SUB]`.
- Press (Marker).
- Press (7) (0) (.) (0) (1) `x M`. The marker moves at 70 MHz points.
- Read the value for sub trace at the right top of display.

The marker has a search function that makes it easier and faster to evaluate the trace results. For example, to search for the maximum value and its frequency on the trace:

- Press (Marker) `MKR SEARCH [ ] SEARCH:MAX`. The marker immediately moves to the maximum point on the displayed trace. Read the frequency and response values displayed at the upper right of the display.

**Note**

When you want to move all markers together, Press (Marker) `MKR MODE MENU MARKERS: COUPLED`.

### Analyzing a filter parameter

- Press (Menu 1) `–3dB BAND WIDTH(MAX)`
- The filter parameter such as, band width, center, Q, insertion loss, delta frequency(left) and delta frequency(right) is displayed at the upper right of the display.

# 5

# Analyzer Feature Tutorial

## Multi-channel Measurement Tutorial

The analyzer has up to four channels. Each channel can measure independently.

### To setup measurement

1. Press (Meas/Format) NUM of CH 2.
2. Confirm that the ACTIVE CH [CH1] at the bottom of softkey is displayed. When the ACTIVE CH [CH2] is displayed, press ACTIVE CH [CH2] to change the active channel to channel 1.
3. Press (Meas/Format) MEAS A/R.
4. Press FORMAT LOGMAG & PHASE.
5. Press ACTIVE CH [CH1] to change to ACTIVE CH [CH2].
6. Press (Meas/Format) MEAS A/R.
7. Press FORMAT LOGMAG & PHASE.
8. Press (Center) (7) (0) x M.
9. Press (Span) (5) (0) (0) x k.

**Note**

When the NUM of CH is set to 3 or 4, the format which has dual trace on one channel, such as LOG MAG & PHASE, is not available.

### To make response calibration

1. Press ACTIVE CH [CH2] to change to ACTIVE CH [CH1].
2. Verify that the measurement traces of channel 1 is displayed.
3. Connect a BNC cable between RF OUT2 and input R.
4. Connect a thru between RF OUT1 and input A.
5. Press (Cal) RESPONSE THRU.
6. The THRU softkey label is underlined when the measurement is completed.
7. Press DONE:.

8. Verify that "Cor" is displayed on the left side of the display to show that the calibration done for channel 1.
9. Press ACTIVE CH [CH1] to change to ACTIVE CH [CH2].
10. Connect that thru between RF OUT and input B.
11. Press RESPONSE THRU.
12. The THRU softkey label is underlined when the measurement is completed.
13. Press DONE:.
14. Verify that "Cor" is displayed on the left side of the display to show that the calibration done for channel 2.

**To measure dut**

1. Connect dut between RF OUT1 and input A.
2. Select ACTIVE CH [CH1] to observe the trace for channel 1.
3. Press (Display) AUTO SCALE to scale automatically for channel 1.
4. Select ACTIVE CH [CH2] to observe the trace for channel 2.
5. Press (Display) AUTO SCALE to scale automatically for channel 2.

### To display the trace of all channel

1. Press (Display) MULTI CH to change MULTI CH on OFF to MULTI CH ON off.
2. The all traces of channel 1 and channel 2 are displayed.
3. Verify that two "Cor" is displayed on the left side of the display. The upper one is for channel 1 and the lower one is for channel 2.

## To measure a dut on different sweep parameter.

**To setup measurement**

1. Press (Meas/Format) NUM of CH 2.
2. Press (Sweep) COUPLED CH to change COUPLED CH ON off to COUPLED CH on OFF.
3. Confirm that the ACTIVE CH [CH1] at the bottom of softkey is displayed. When the ACTIVE CH [CH2] is displayed, press ACTIVE CH [CH2] to change the active channel to channel 1.
4. Press (Meas/Format) MEAS A/R.
5. Press FORMAT LOGMAG & PHASE.

6. Press (Center) (7) (0) x M.
7. Press (Span) (5) (0) (0) x k.
8. Press (Meas/Format) ACTIVE CH [CH1] to change to ACTIVE CH [CH2].
9. Press (Meas/Format) MEAS A/R.
10. Press FORMAT LOGMAG & PHASE.
11. Press (Sweep) SWEEP TYPE MENU POWER.
12. Press (Start) (-) (6) (0) x 1.
13. Press (Stop) (0) x 1.

### To make response calibration

1. Connect that thru between input R and input A.
2. Press (Cal) RESPONSE THRU.
3. The THRU softkey label is underlined when the measurement is completed.
4. Press DONE:.

### To measure dut

1. Connect dut between input R and input A.
2. Select ACTIVE CH [CH1] to observe the trace for channel 1.
3. Press (Display) AUTO SCALE to scale automatically.
4. Select ACTIVE CH [CH2] to observe the trace for channel 2.
5. Press (Display) AUTO SCALE to scale automatically.

### To display the trace of all channel

1. Press (Display) MULTI CH to change MULTI CH on OFF to MULTI CH ON off.
2. The all traces of channel 1 and channel 2 are displayed.

### To split the display graticule

1. Press (Display) SPLIT DISP to change SPLIT DISP on OFF to SPLIT DISP ON off.
2. The graticule for channel 1 and channel 2 is split one over another.

**Note**

With COUPLED CH OFF, the stimulus values of each channels depends on the number of channels as describes below.

| NUM of CH | When COUPLED CH is OFF: |
|---|---|
| 2 | Ch1 and Ch2 can have different stimulus. |
| 3 | Ch1 and Ch2 have same stimulus. Ch3 can have different stimulus from Ch1 and Ch2. |
| 4 | Ch1 and Ch2 have same stimulus, and Ch3 and Ch4 have same stimulus. Ch1 and Ch2 can have different stimulus from Ch3 and Ch4. |

## To make list sweep

The analyzer has a list sweep function which can sweep frequency according to a predefined sweep segment list. Each sweep segment is independent and can have a different number of sweep points, power level, and IF bandwidth value. A segment looks like a normal stimulus sweep setting, and the list sweep function can combine up to 801 total sweep points into one sweep. The analyzer can have 2 different sweep lists (list 1 and list 2). Either one can be used, or both can be used for 2 channels (under the Coupled channel off condition). This section describes the following three applications:

- Sweep time reduction for filter testing (with setup procedure)
- Dynamic range enhancement
- Use of order base display mode

The following is an example of creating a list sweep to measure a filter that has a 70 MHz center frequency and a 20 kHz bandwidth. This example uses the list sweep to reduce the sweep time by setting coarse sweep points for the rejection band and fine sweep points for the passband.

### To create sweep List

1. Press (Sweep) SWEEP TYPE MENU MORE LIST EDITOR.
2. The list table editor is displayed.
3. Confirm that the cursor positions at (SEG1, START).
4. Press 6 9 . 9 x M.
5. Press → to move the cursor to the right cell.
6. Press 6 9 . 9 6 x M.
7. Press → to move the cursor to the right cell.

8. Press 3 0 x 1.
9. Press → to move the cursor to the right cell.
10. Press 0 x 1.
11. Press → to move the cursor to the right cell.
12. Press 2 0 0 x 1.
13. Press INSERT SEGMENT.
14. The cursor moves to (SEG2, IFBW).
15. Input the data for segment 2 and 3 as shown in Figure 5-1.
16. Press MORE END EDIT to exit the list editor.

**Note**

The segments do not have to be entered in any particular order: the analyzer automatically sorts them in increasing order of stimulus value when the list table editor is ended.

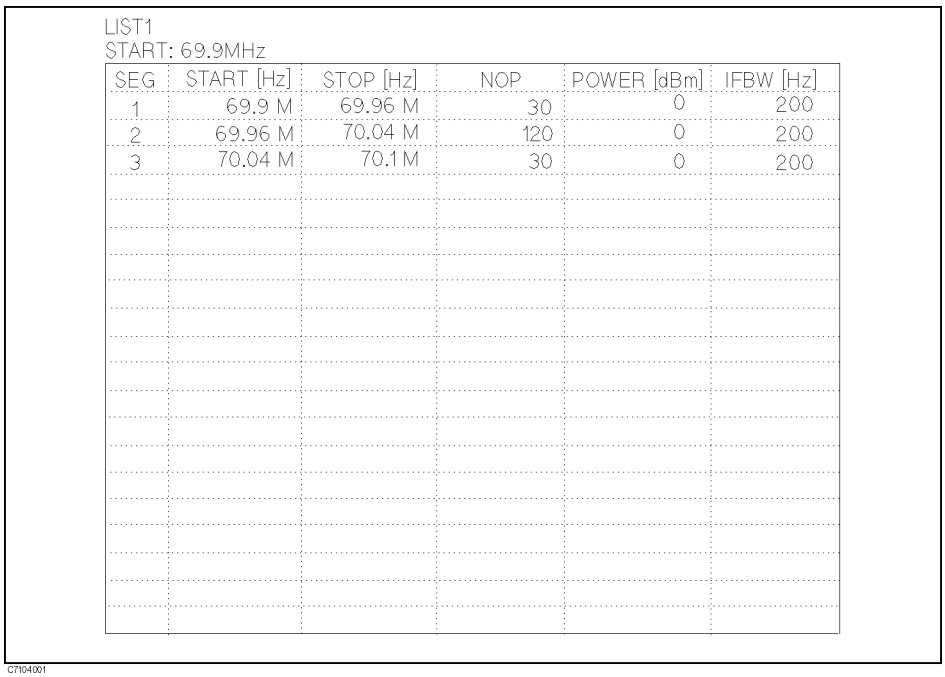



**Figure 5-1. Sweep List Edit Display**

## To perform list sweep

1. Press (Sweep) SWEEP TYPE MENU LIST to perform the list sweep measurement using the just edited list.

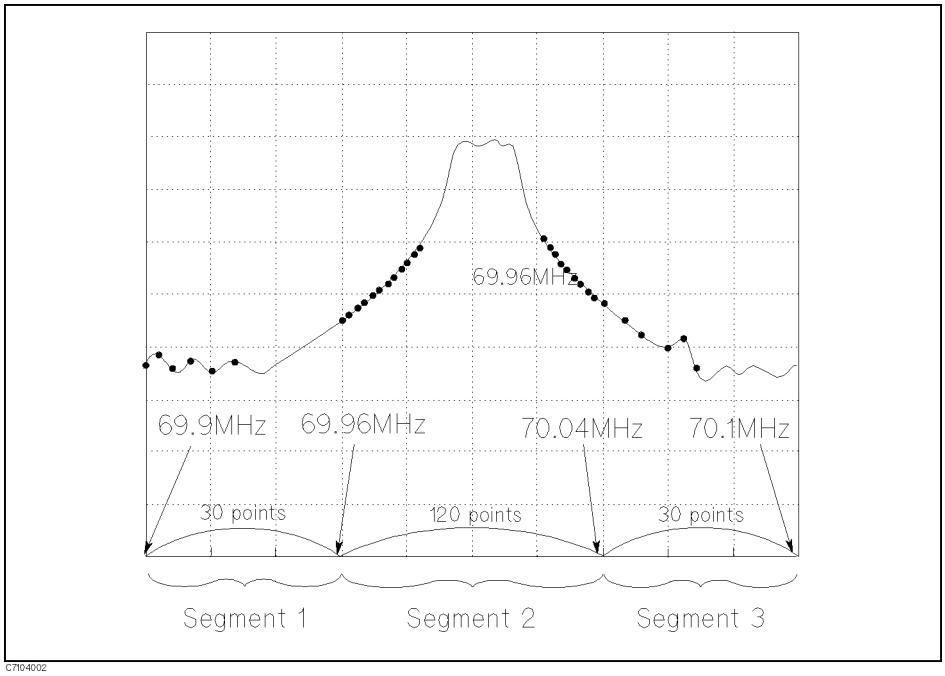



**Figure 5-2. List Sweep Measurement**

## To increace Dynamic Range Enhancement

The sweep list modified from the list of the previous example to improve dynamic range. Segments 1 and 3 have a narrow IF bandwidth and a higher power level for the stopband of the filter. Segment 2 has wide IF bandwidth and lower power level for passband. These settings enhance the analyzer's dynamic range. Figure 5-3 shows a example.

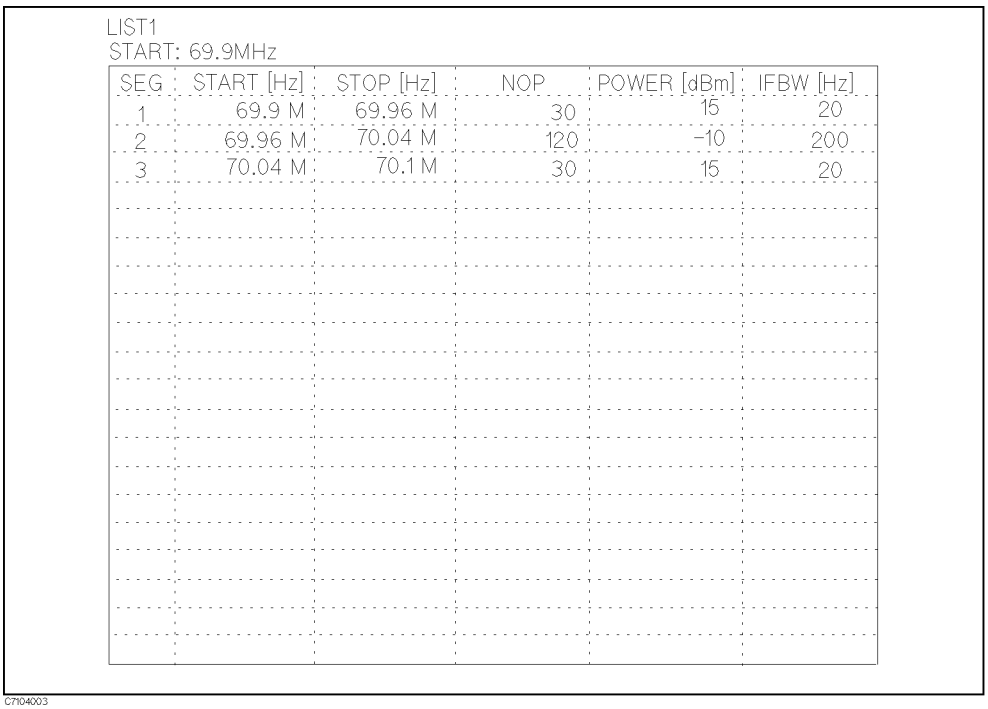



**Figure 5-3. List Sweep Example (Dynamic Range Enhancement)**

## Use of Order Base Display Mode

The result of list sweep is displayed using one of the following two display modes.

- Frequency Base Display Mode : The X-axis is linearly scaled by frequency. The analyzer automatically linearly scales from the sweep list.
  - To select the frequency base display, press (SWEEP) SWEEP TYPE MORE LIST DISP: FREQ BASE.
- Order Base Display Mode : The X-axis is linearly scaled by the number of sweep points according to the sweep list.
  - To select the order base display, press (SWEEP) SWEEP TYPE MORE ORDER BASE

# Disk Drive Tutorial

The analyzer's 3.5 inch built-in disk drive, RAM disk and FLASH disk can be used to save instrument states, measurement data, and Instrument BASIC programs. The built-in disk drive supports the DOS file format which is used for IBM-PC and compatible computers. The RAM disk is 256kbyte volatile storage and the FLASH disk is 256kbyte non-volatile storage. The commands of save/recall access only the RAM disk directly. Pressing `BACKUP MEMO DISK` key makes the all contents in the RAM disk copy to the FLASH disk. At power on, the all files in the FLASH disk copy to the RAM disk. This section describes the basic procedure for using the analyzer's disk drive.

## Selecting Storage Devices

1. Press (Save/Recall) then using `STOR DEV [ ]` to select the built-in flexible disk drive and the memory. When the flexible disk drive is selected, `[A:DISK]` is displayed. When the RAM disk is selected, `[B:MEMO]` is displayed.

## To save file to a floppy disk

1. Press (Save/Recall), and select `STORE DEV [A:DISK]` by pressing that key.
2. Insert a disk into the disk drive.
3. If the floppy disk is new, you must initialize the disk. Press `FILE UTILITIES` `INITIALIZE` `INITIALIZE A:DISK: YES` to initialize disk.
4. The instrument will save the file to the current working directory of floppy disk. If you want to save the file in another directory, move the working directory. Refer to "To change working directory".
5. Press (Save/Recall) `SAVE`.
6. When both instrument state and measurement data are to be saved, press `ALL`. When only the instrument state is to be saved, press `STATE ONLY`. When only binary format measurement data is to be saved, press `DATA ONLY (BINARY)`. When only ASCII format measurement data is to be saved, press `DATA ONLY (ASCII)`.
7. Enter the file name by selecting letters or input from keyboard.
8. After entering the file name, press `DONE` to complete this task.

**Note**

Initialization *destroys* all current data on a disk. You can NOT recover the data once it has been destroyed by the initialization process.

**Note**

Saving DATA ONLY won't allow the recall of operating parameters such as start/stop frequency, list sweep tables and limit lines. You must save state only or a ALL for this information.

## To save file to a RAM disk

9. Press (Save/Recall), and select `STORE DEV [B:MEMO]` by pressing that key
10. Press (Save/Recall) `SAVE`.
11. The instrument will save the file to the current working directory of RAM disk. If you want to save the file in another directory, move the working directory. Refer to "To change working directory".
12. When both instrument state and measurement data are to be saved, press `ALL`. When only the instrument state is to be saved, press `STATE ONLY`. When only binary format measurement data is to be saved, press `DATA ONLY (BINARY)`. When only ASCII format measurement data is to be saved, press `DATA ONLY (ASCII)`.
13. Select letters for the input file name.
14. After entering the file name, press `DONE` to complete this task.
15. When you want to use all files in the RAM disk after power on again, press `BACKUP MEMO DISK`.

**Note**

Saving DATA ONLY won't allow the recall of operating parameters such as start/stop frequency, list sweep tables and limit lines. You must save state only or a ALL for this information.

## To recall a file

At power on, all files in the FLASH disk copy to the RAM disk.

1. Press (Save/Recall) `RECALL` to display the file names in the center of display.
2. Change the working directory when you want to save a file to another directory. Refer to "To change working directory".
3. Select the file name you want to recall using arrow keys, and then press (ENTER). If you can not find the file name you want to select, press `NEXT PAGES` or `PREV PAGES` until the file name is displayed.

**Note**

The file names are labeled with the following file type identification extensions after the file name:

- `.ALL`: means all (instrument state and measured data:binary)
- `.STA`: means instrument state only (BINARY).
- `.DAT`: means measured data only (BINARY).

## To change working directory

Since all disk operations of the analyzer work on the current directory, you must change the desired directory before the disk operation is executed.

1. Press (Save/Recall) FILE UTILITIES.
2. The directory list is displayed on the center of display.
3. Select the desired directory name using arrow keys.
4. Press CHANGE DIRECTORY.

## To recall a file at power on

By storing the instrument state in the special file named "AUTOREC" to the FLASH disk or flexible disk drive, you can automatically recall the instrument state from an inserted disk every time the analyzer is turned on.

# A

# Manual Changes

## Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the E5100A/B than the current printing date of this manual. The information in this manual applies directly to the E5100A/B serial number prefix listed on the title page of this manual.

## Manual Changes

To adapt this manual to your E5100A/B, see Table A-1 and Table A-2, and make all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument's serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

In additions to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Agilent Technologies recommends that you periodically request the latest *MANUAL CHANGES* supplement.

For information concerning serial number prefixes not listed on the title page or in the *MANUAL CHANGE* supplement, contact the nearest Agilent Technologies office.

To confirm the program version, `LOAD` and `RUN` the program or confirm the beginning part of the program by typing `EDIT`.

**Table A-1. Manual Changes by Serial Number**

| Serial Prefix or Number | Make Manual Changes |
|---|---|
| JP1KC | none |
| JP2KC,JP3KC,JP4KC,JP5KC | none |

**Table A-2. Manual Changes by Firmware Version**

| Version | Make Manual Changes |
|---|---|
| REV.1.XX | none |
| REV.2.xx, 3.xx | none |

## Serial Number

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (see Figure A-1) attached to the rear panel. The first five characters are the serial prefix and the last five digits are the suffix.

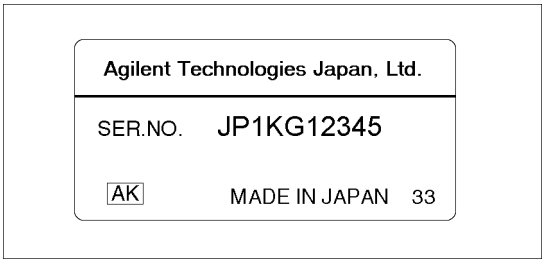



**Figure A-1. Serial Number Plate (Sample)**

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